we may be dealing with a system of multiple allelomorphs. No two of the types when mated together give a third in F_1; and, unless one or both carry a recessive in heterozygous form, any two types give a 3:1 ratio in F_2, or 1:1 on back-crossing to a recessive. The four patterns involved seem, from the descriptions, to fall roughly into a series in the order striped, moricaud, normal, and plain. That is to say, the second two are rather intermediate in appearance between striped and plain. Although I believe any arguments as to the nature of genes which are based on the appearance of characters are open to very serious objections, it must still be admitted that the different characters involved in a case of multiple allelomorphism are generally of the same sort.[4]

On the chromosome view, if the genes just discussed are allelomorphs they occupy identical loci in homologous chromosomes. If they are not allelomorphic but closely linked, they occupy different but closely opposed loci in homologous chromosomes. In either case, any combination of them should give approximately the same linkage to the Y–y pair of genes, which occupy a locus in the same chromosome, but some distance away. The linkage of the striped-normal, striped-plain, and moricaud-plain combinations with the Y–y locus appear from Tanaka's data to be in fact about the same, though the data on the first (striped-normal) are the only ones sufficiently large to be very significant.

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THE INFLUENCE OF POSITION IN THE POD UPON THE WEIGHT OF THE BEAN SEED

IN a note on the pure line problem Belling[1] has emphasized the significance of position in the pod as a factor in determining the weight of the bean seed. Since this point in his paper seems to have attracted some attention among those interested in genetics, it may not be out of place to call attention to a series of quantitative determinations of the intensity of the relationship[2] and to illustrate the results secured.

If one numbers the successive ovules of the pod from 1 up,

[4] I have discussed this aspect of the matter briefly in another paper (AMER. NAT., XLVII, 1913, p. 237).

[1] Belling, J., "Selection in Pure Lines," *Amer. Breed. Mag.*, 3: 311–312, 1912.

[2] Harris, J. Arthur, "A Quantitative Study of the Factors Influencing the

he may regard the numbers as measures (in units of intervals between adjacent ovules) of the distance of ovules from the

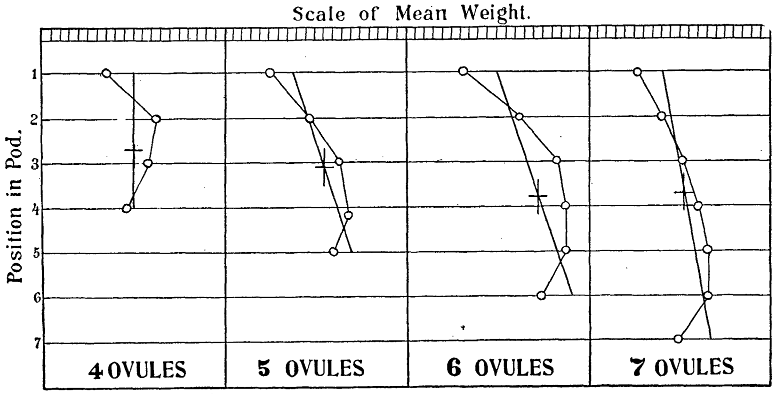

FIG. 1.

proximal end of the pod, and may then express in terms of correlation the relationship between the weight of the seed and its position in the pod.

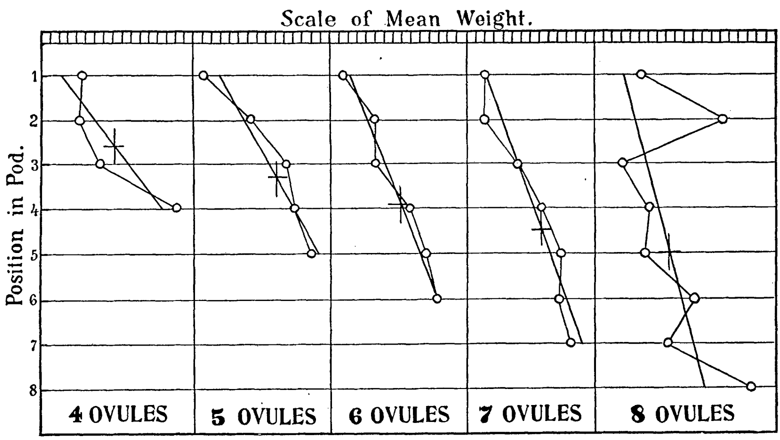

FIG. 2.

In doing this, the pods should of course be sorted into classes according to the number of ovules which they produce and the relationship computed for each group of pods separately, for there is no reason for believing that the fourth in a pod with 4 ovules is comparable with the fourth seed in a pod with six. This

Weight of the Bean Seed. I. Intra-Ovarial Correlations,'' *Beih. Bot. Centralbl. Abt.*, I, 31: 1–12, Pl. 1–4, 1913.

has now been done for twenty series of pods, drawn from five cultures belonging to three distinct varieties (Navy, Golden Wax and Burpee's Stringless) and embracing altogether about 23,000 individually weighed seeds. In every one of these cases a positive correlation has been found, *i.e.*, the weight of the seed increases as its distance from the base of the pod becomes greater. The intensity of this interdependence is, however, not very great, at least in the varieties so far studied. The correlations range from $.014 \pm .046$ to $.238 \pm .068$, with an average value of about .132, or about 13 per cent. of perfect correlation.

The rate of change has been expressed by the slope of a straight line for four different classes of pods studied for a culture of Navy beans made at Sharpsburg, Ohio, in 1907 (Diagram 1[3]) and for five classes from a culture of Burpee's Stringless beans grown at the Missouri Botanical Garden in the same year.

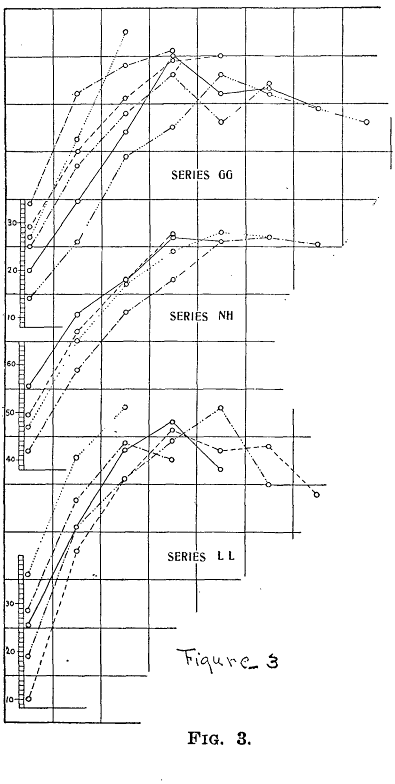

FIG. 3.

In the first of these, the Navy series, it appears that the observed mean weights at first increase rather rapidly, then the rate of increase falls off and finally the seeds nearest the tip (distal or "blossom" end of the pod) become somewhat lighter than those a little lower down. Here a curve would fit the observed means better than a straight line. In the Burpee's Stringless culture (Fig. 2) however, the change in seed weight can for all practical purposes be represented by a straight line as well as by any curve.

The percentage of ovules which develop into seeds also increases from the base toward the stigmatic end of the pod. In small pods the rate of increase may be fairly regular, but in larger pods

[3] In the diagram for this series published in the original paper there is a slip in the representation of the slope of the line for pods with 4 ovules.

it falls off toward the stigmatic end, where the fecundity may be even lower than it is a little farther down in the pod. This is admirably shown in Diagram 3, in which *GG* stands for a series of Burpee's Stringless grown at the Missouri Botanical Garden, *NH* for a series of Navy beans grown at Sharpsburg, Ohio, and *LL* for a series of Golden Wax beans grown at Lawrence, Kansas. All were grown in 1907. Here the percentage of development of ovules at different positions in the pod is shown for the different classes of pods by the scales to the left of the figures. The reader may ascertain the class of pods represented by any particular curve by noting the number of circles representing percentage development in the various positions. These correspond to the number of ovules per pod. In the diagrams the positions (abscissæ) from left to right represent the positions from the base to the tip of the pod.

J. Arthur Harris

ANOTHER GENE IN THE FOURTH CHROMOSOME OF DROSOPHILA

Until the appearance of bent wings, only three groups of linked genes had been found in *Drosophila amelophila,* although four pairs of chromosomes had been identified in the diploid group. Since the character bent wings, worked out by Mr. H. J. Muller, was found to be unassociated with any of the three groups, the gene producing this character was said to be located in the fourth chromosome.

Recently a new character, designated as eyeless, appeared. Flies having this character either lacked eye pigment and ommatidia or had one or both eyes reduced in size. All of the pure stock showed some loss of eye structures. Eyeless is recessive to the normal eye. In order to determine the linkage, eyeless males were crossed in turn to females of the stocks at Columbia University. These stocks representing the three groups were (1) miniature wings, (2) black body and vestigial wings, and (3) spread wings. The genes producing these characters are in the first, second and third chromosomes, respectively. The F_1 from all three crosses had normal eyes. They were inbred in each case and gave the following.

The equation should be $w = 9.987 + .021\ p$. The line as it appears here is correctly drawn.